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A code system for parallel modifications seems eminently desirable, but I think it should follow the character of the modification, rather than the cause, the latter being often obscure. To designate a particular form as a "shade form," for instance, seems to me to artificially simplify matters and obscure the actual facts. With shade are usually associated increased moisture and decreased temperature; but in certain places and at certain times, the exact reverse is true. In all this, we come back to the great fact of the complexity of natural phenomena; and while we seek everywhere for general laws and find them in operation, we must not forget the Linnean motto: "Natura maxime miranda est in minimis."

UNIVERSITY OF COLORADO,  
BOULDER, COLORADO.

## NOTES ON THE LIFE AND WORK OF CHARLES C. FROST \*

BY WILLIAM A. MURRILL

Charles Christopher Frost, the "shoemaker botanist" of Brattleboro, Vermont, by integrity and simplicity of life and singleness of purpose in his work and in his recreation amassed a modest fortune and greatly advanced the knowledge of the flora of his native state.

A plain man, of great modesty, he repeatedly declined scientific positions and honors, and stuck to his trade of shoemaking during his entire working life, occupying the same shop for a period of forty-nine years. When asked the reason for this he replied, "Whatever I have acquired of science, in my life, came through search for health and mental entertainment; science is not my profession—shoemaking is." His character was formed along strictly puritanical lines, industry, simplicity, reserve, and deep religious conviction being its prominent characteristics.

Frost's success was due to a splendid intellect and close application. He had no advantages, except those afforded by a small

\* Editor's Note.—This article forms an interesting introduction to Dr. Murrill's paper on the *Boleti* of the Frost Herbarium, which is to be published in the *Bulletin*.

village school kept open during the winter months, and this he left in his fifteenth year to help his father in the shop, resolving, however, to set aside for the rest of his life an hour each day for study. Mathematics first absorbed his attention, but a love for the natural sciences was soon acquired and this was fostered by collections of insects, shells, and other natural objects.

He became a botanist through the advice of a noted New York physician, whom he consulted regarding a severe case of dyspepsia with which he was afflicted. The physician frankly told him that he could do nothing for him, but that he could do everything for himself, and suggested that he devote an hour each morning and an hour each afternoon to the observation and study of plants in the field. Following this excellent advice, it was not long before Frost was on the road to health, and also to fame as a botanist. He purchased some botanical works and a good microscope, acquired a knowledge of Latin, French, and German, and devoted practically all of his leisure time henceforth to the study of plants growing wild in the region of Brattleboro. Excursions were often made in the early morning before the shop was opened, and during the day and in the evening he was rarely seen without an open book beside him. Half of the noon hour was regularly spent in the attic with his plants, and most of his microscopic work must have been done at that time. On rare occasions, when Sprague or some other intimate botanical friend paid him a visit of a day or two, the shop would be closed for the entire period; but it was by the faithful and constant use of the leisure moments of a busy life that most of his knowledge was acquired.

Frost's botanical work was done between 1845 and 1875. The published results of this work are very meager, consisting chiefly of catalogues of cryptogamic plants occurring in New England.\* The first catalogue contained additions to the fungi

\* Further Enumeration of New England Fungi. Proc. Boston Soc. Nat. Hist. 12: 77-81. 1869.

Catalogue of Boleti of New England, with Descriptions of New Species. Bull. Buffalo Soc. Nat. Sci. 2: 100-105. 1874.

A Catalogue of Plants Growing Without Cultivation within Thirty miles of Amherst College. By E. Tuckerman and C. C. Frost, 1875.

previously listed by his friend Sprague, of Boston, who turned over to him his remaining material in 1860 and asked him to continue the work. In the eight years that followed, Frost succeeded in adding 263 species to Sprague's revised list of 678. Only three of these additions were *Boleti*, and two of them were omitted from the Amherst Catalogue, as foreign to New England.

The second publication cited is a list of the 47 species of the genus *Boletus* found in New England, 22 of which were described as new. This is perhaps his most important work, judging from the standpoint of publication, since it contains descriptions, and not names only.

The third catalogue, prepared in collaboration with Tuckerman, is by far the most pretentious of his publications, being a summary of his entire botanical knowledge regarding New England mosses, liverworts, stoneworts, and fungi, so far as this knowledge could be expressed in a mere list of species. The work contains 98 pages, 44 of which are contributed by Frost, 36 of these being devoted to fungi. Under the genus *Boletus*, 46 species are listed, and one species each under *Strobilomyces* and *Fistulina*. Of the 1,190 species of fungi listed, 60 were first described by Frost, 40 of these being *Boleti* and gill-fungi.

In the absence of more extensive and detailed published results, it is no doubt true that Frost's herbarium represents his most valuable botanical work. This was retained by his family for ten years after his death, and then deposited by them, in 1890, with the Natural History Society of Brattleboro for a period of twelve years, when it was decided to transfer the entire collection to the University of Vermont. At that time the number of cryptogams in the collection was estimated at from three to five thousand specimens.

Frost's botanical library, consisting of about 100 bound volumes and various manuscripts and drawings, was also deposited with his herbarium. Among his most helpful books on fungi were some of the works of Berkeley, Cooke, Persoon, Fries, Schweinitz, Rabenhorst, Tuckerman, and Peck. Sprague sent him a number of his pen drawings of Agarics, and he had copies of many colored figures of *Boleti* taken from published illustrations.

The fungi were kept by Frost in paper boxes or glued flat to sheets of blank books. It is said that these were considerably disturbed soon after his death by visiting botanists. A number of the fleshy forms were much injured by mould but none was wholly destroyed, so far as I know. The specimens of *Boleti*, probably the cream of the entire collection, have been most generously placed at my disposal by the university authorities for critical examination, and the results of this study will be published in a short time.

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## REVIEWS

### Lewis's Plant Remains of the Scottish Peat Mosses\*

This study by F. J. Lewis of the plant remains of the Scottish peat bogs, of which Part 3 dealing with the eastern and northwestern Highlands, Shetland Islands, Outer Hebrides, etc., has just reached this country, is a model in English of the line of work so successfully pursued by Nathorst, Gunnar-Andersson, and others of their countrymen, but published for the most part in Swedish and Danish and consequently inaccessible to most students. While the sequence of events as found by Lewis in Scotland is somewhat variable as would be naturally expected when the varying physical conditions of deposition are taken into account, the general order is sufficiently uniform to enable him to make some very interesting correlations between the different areas.

The following is a somewhat generalized abstract of this march of events in the late Pleistocene: The oldest beds found (exclusive of the rock floor) are glacial sands and till which are referred to the fourth Glacial or Mecklenburgian stage. These are followed by desposits containing arctic plants, indicating tundra conditions. Upon these are superposed the peat deposits of the fourth Interglacial period with *Betula*, *Corylus*, *Potentilla*, *Menyanthes*, *Salix*, etc. This forest bed or scrub is gradually exterminated by *Sphagnum* and the indicated wet moorland condition persists to the fifth

\* The Plant Remains in the Scottish Peat Mosses. By F. J. Lewis. Part 1, Trans. Royal Soc. Edinb. 41<sup>3</sup>: 699-724. pl. i-vi. 1905; Part 2, Ibid., 45<sup>2</sup>: 335-360. pl. i-v. 1906. Part 3, Ibid., 46<sup>1</sup>: 33-70. pl. i-iv. 1908.